

MORTONIODENDRON (TILIACEAE) AND SPHAEROPTERIS/TRICHIPTERIS (CYATHEACEAE) IN CENOZOIC DEPOSITS OF THE GULF-CARIBBEAN REGION¹

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ABSTRACT

Two previously unidentified palynomorphs are common in Upper Tertiary deposits in the southern Gulf-Caribbean region. One is now identified as pollen of *Mortoniodendron* (Tiliaceae; Upper Miocene of Veracruz, Mexico, Middle Miocene of Panama, Pleistocene of Panama). The other represents spores of *Sphaeropteris/Trichipteris* (Cyatheaceae; Upper Miocene of Veracruz, Mexico). Neither have previously been reported in the fossil record.

For a number of years two very distinct, unidentified palynomorphs have been known from Cenozoic deposits in the southern Gulf-Caribbean region. One of these is a relatively small, oblate, tricolpate, finely reticulate pollen grain with conspicuous endexine thickenings about the shortened colpus (costae colpi). The other is a trilete spore with numerous conspicuous pits in the wall. The biological affinities of the microfossils were unknown, but considering the relatively recent age of the specimens and their distinctive morphology, it seemed likely identifications would eventually be made. Both microfossils have now been identified, and they represent genera previously unreported in the fossil record.

MORTONIODENDRON (Tiliaceae)

Pollen description (fossil).—Peroblate, oval-triangular in polar view; tricolpate, the colpi equatorially arranged, meridionally elongated, equidistant, the inner margin entire, short (ca. 3.5 μm apex to equator), conspicuous costae colpi ca. 1.5–2 μm wide; semitectate; finely to moderately reticulate (diameter of the lumen from ca. 1 μm to 3 μm at the poles, finer toward the equator), reticulum closed, regular, the muri ca. 0.5 μm wide, straight to occasionally slightly sinuous, the surface psilate, the margins entire; size 18–27 μm .

This pollen type was recovered from the Upper Miocene Paraje Solo Formation, exposed in southeastern Veracruz state near the port of Coatzacoalcos, Mexico (Graham, 1976: 840, figs. 248–255; Fig. 3, this report). Later specimens were also found in core material from Gatun Lake, Canal Zone, Panama (Fig. 2). These sediments are from the Gatun Formation and are Middle Miocene in age. Bartlett & Barghoorn (1973: 242) reported similar specimens from Pleistocene deposits of the Canal Zone and suggested they may represent *Mortoniodendron*, although reference material was not available to them. The specimens have long been thought to represent some member of the Tiliaceae, or possibly the Stercu-

¹ I gratefully acknowledge reference pollen material and information on *Mortoniodendron* provided by Lorin Nevling (Field Museum). Gerald Gastony (Indiana University) provided spore material of *Sphaeropteris* and *Trichipteris*, as well as the SEM photomicrograph of *Sphaeropteris*, and his help and suggestions are sincerely appreciated.

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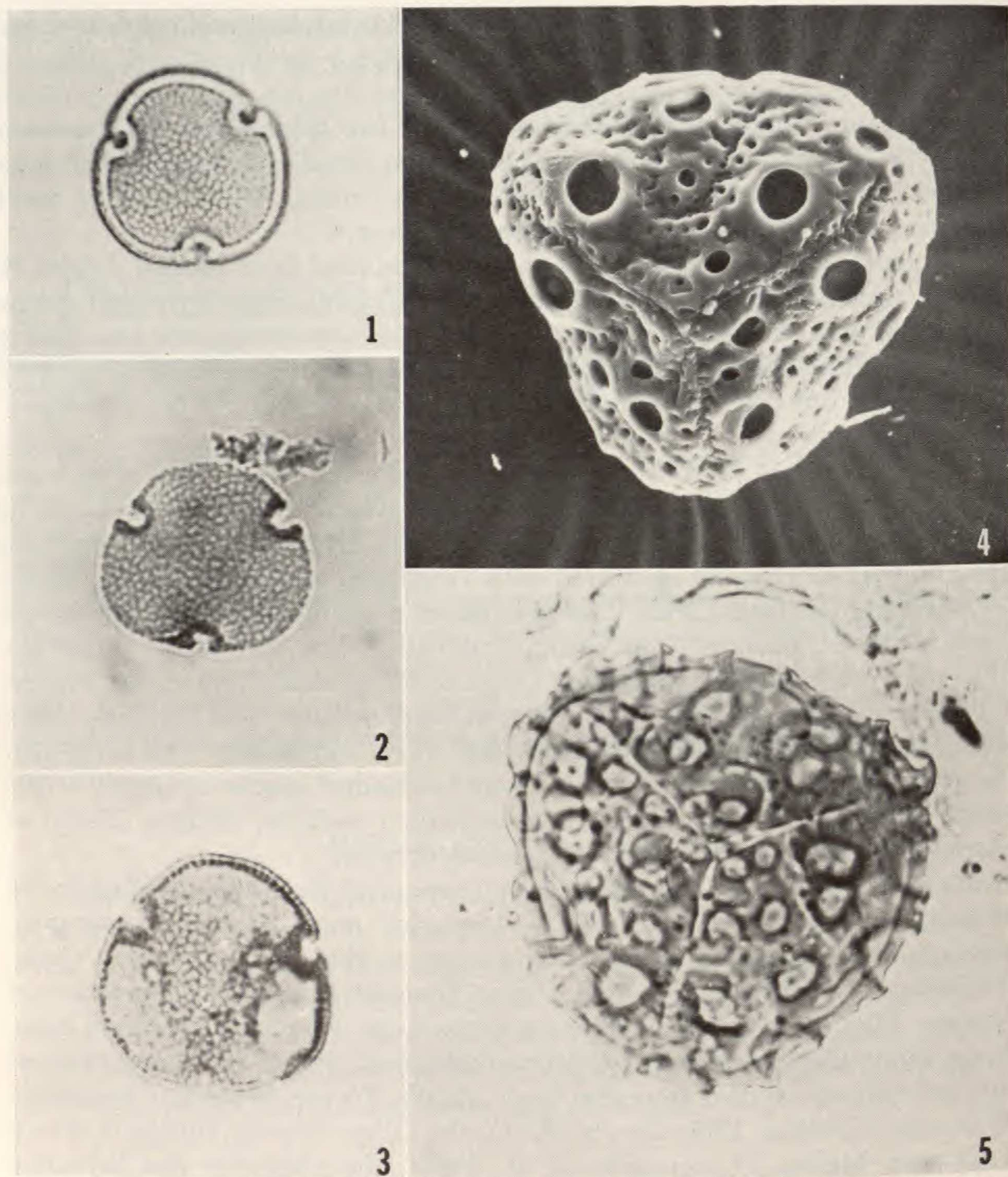
liaceae, because of the distinctive thickenings about the shortened colpi, as occur in *Tilia*. The principal difference between the fossil specimens and pollen of *Tilia* is that the fossil grains are only about half the size (ca. 18–27 μm vs. 40–50 μm). Limited amounts of flowering material of two species (*M. guatemalense* Standley & Steyermark, Fig. 1; *M. membranaceum* Standley & Steyermark) were obtained from the Field Museum (Nevling, pers. comm., 1976), and the fossil specimens can now be referred to *Mortoniiodendron*.

The genus consists of about five species distributed from Mexico (states of Chiapas, Veracruz) through Central America. The plants range from small shrubs ca. 1 m tall (*M. hirsutum* Standley, Panama; *M. membranaceum* Standley & Steyermark, Honduras) to tall tropical forest trees (*M. anisophyllum* (Standley) Standley & Steyermark, Costa Rica, Panama). In Costa Rica the genus is represented in the lowlands of the Golfo Dulce by *M. anisophyllum* and *M. guatemalense* var. *australe* Morton & Steyermark. There the former species includes trees up to 30 m tall, and with the larger specimens strongly buttressed. In Veracruz *M. guatemalense* occurs in the Selva Alta Perennifolia (high evergreen selva, tropical rain forest) associated with *Terminalia amazonia* (Gmell.) Exell, *Calophyllum brasiliense* Camb., *Dialium guianense* (Aubl.) Sandwith, *Bernoullia flammea* Oliver, *Brosimum alicastrum* Sandwith, *Ficus tecolutensis* (Liebm.) Miq., and *Pseudolmedia oxyphyllaria* Donn.-Smith as dominants. Other aspects of the distribution and ecology of *Mortoniiodendron* have been noted by Allen (1956: 268–269), Gómez-Pompa (1973: 108, 111), and Robyns (1964: 15–18). The genus is poorly known taxonomically and individual species are rarely represented by both flowering and fruiting herbarium material; Robyns (Paris) is presently preparing a monograph of *Mortoniiodendron*.

There have been too few studies in neotropical Cenozoic paleobotany to accurately summarize the probable stratigraphic range and paleogeographic distribution of *Mortoniiodendron*. It is present in the Middle Miocene Gatun Formation of the Canal Zone, the Upper Miocene Paraje Solo Formation of Veracruz, Mexico, and in the Pleistocene Gatun Lake deposits of the Canal Zone; all are within the present range of *Mortoniiodendron*. It has not been recovered from palynofloras studied from the lower Middle Eocene Chapelton Formation of Jamaica (Graham, 1977; unpubl. data), the Oligo-Miocene Simojovel Group of Chiapas, Mexico (Langenheim et al., 1967), the Oligocene San Sebastian Formation of Puerto Rico (Graham & Jarzen, 1969) or from the several Eocene to Oligo-Miocene microfloras presently under study from Panama (Graham, unpubl. data). It is not mentioned in Germeraad et al.'s extensive 1968 summary of Tertiary palynology of South America. To my knowledge it has not been reported from either the modern or fossil floras of South America, nor is it presently known from the megafossil record. Thus on the basis of information currently available, *Mortoniiodendron* ranges from Middle Miocene to Recent, based on three known occurrences in southern Mexico and the Canal Zone.

SPHAEROPTERIS/TRICHIPTERIS (Cyatheaceae)

Spore description (fossil).—Radially symmetrical, the amb oval-triangular, the margin lobate (from pits in equatorial section); trilete, the arms straight,



FIGURES 1-5.—1. Modern pollen of *Mortoniodendron*, ca. 20 μm .—2. Fossil pollen of *Mortoniodendron*, Gatun Formation, Panama, core SL 103, Harvard University No. 31, 253' depth, slide No. 3, England Slide Finder Coordinates D-47, 3,4, ca. 22 μm .—3. Fossil pollen of *Mortoniodendron*, Paraje Solo Formation, Veracruz, Mexico, slide 34-1, ESF coordinates L-30, 1-3, 27 μm .—4. SEM photomicrograph of spore of modern *Sphaeropteris myosuroides*, ca. 55 μm .—5. Fossil spore of *Sphaeropteris/Trichipteris*, Paraje Solo Formation, Veracruz, Mexico, slide 10-1, ESF coordinates C-45, 65 μm .

narrow, the margins entire, ca. 18 μm long, extending ca. $\frac{2}{3}$ the distance from the pole to the equator; wall conspicuously pitted, the pits circular, 1.5–4 μm diameter, the inner margin entire, the raised border ca. 1.5 μm wide, irregularly distributed; size ca. 55 μm .

The distinctive feature of these spores is the conspicuous pits in the wall

(Fig. 5). Initially it was thought these were made by chytridiaceous phycomycete fungi, or were imprints of mineral crystals. Both conditions are occasionally observed on fossil pollen and spores. Photographs were circulated among palynologists and similar opinions were expressed. This view was supported by the irregular distribution of the pits over the spore surface. Later, however, additional specimens were recovered and it seemed more likely the pits were a natural feature of the spore ornamentation. It was further assumed that the spores probably represented some member of the Cyatheaceae because somewhat similar pits occur in *Hemitelia* (*Cnemidaria*).

In 1976 Gastony and Tryon published a paper on the spore morphology of the Cyatheaceae, which included photographs of *Sphaeropteris*. These spores (especially their fig. 65) were very similar to the fossil specimens recovered from the Upper Miocene Paraje Solo Formation of Veracruz, Mexico. In addition to *S. myosuroides* (Liebm.) Tryon (Fig. 4), however, Gastony (pers. comm., 1976) also provided spore material of *Trichipteris mexicana* (Mart.) Tryon which were also similar. The fossil specimens resembled most closely those of *Sphaeropteris*, based on minor quantitative differences, but since no consistent distinguishing feature could be found, the spores are identified as *Sphaeropteris/Trichipteris*.

Both *Sphaeropteris* and *Trichipteris* are tree fern genera presently occurring in the modern vegetation of Veracruz. *Sphaeropteris myosuroides* is a lowland species of the tropical rain forest, but ranges into more temperate communities (Gómez-Pompa, 1973: 110). It occurs in Cuba and from Mexico south to Nicaragua at elevations from ca. 10 to 600 m. *Trichipteris mexicana*³ occurs from Mexico to Honduras in the tropical rain forest, cloud forest, and along waterways, but grows at higher elevations (800–3,000 m). Since the microfossils are preserved in lignites, deposited under lowland, coastal conditions, ecological considerations would favor *Sphaeropteris* entering this depositional environment.

Another species, *Trichipteris microdonta* is also widespread from northern Latin America into South America and occurs from sea level to 1,700 m, including one report from brackish coastal waters in Nicaragua (Barrington, 1978). However, the spores of this species have a perine of hairlike processes covering an exine which is strongly but finely pitted on both the proximal and distal faces (Gastony, pers. comm., 1978), and thus are quite different from the fossil specimens.

To my knowledge spores of *Sphaeropteris/Trichipteris* are presently known only from the Paraje Solo Formation, and the genera have not been reported in the megafossil record. Other information on ecology and distribution are given by Windisch (1977) and Barrington (1978).

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³ Corrected name of *T. bicrenata* in Gastony & Tryon (1976; Gastony, pers. comm., 1976).

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ADDENDUM: In galley a paper by Tschudy and van Loenen (1970, U.S. Geol. Surv. Prof. Paper 643-E, Figs. 11a,b, 14, 15) was found reporting specimens similar to *Mortoniodendron* from the Upper Eocene of Mississippi under the name *Tiliaepollenites*. This extends the geographic range to Mississippi and the stratigraphic distribution from Upper Eocene to Present.